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ORGANIZATION AND STRUCTURE OF THE NOAA/EDIS/NGSDC 30-SECOND AVERAGE ELEVATION DATA

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Final Report for

Contract 28-K2-242
Rocky Mountain Forest and Range Experiment Station
U. S. Forest Service
Fort Collins, Colorado

By

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and

Joseph E. Childs

December 1982

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Prepared for

Rocky Mountain Forest and Range Experiment Station
Contract 28-K2-242

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December 1982

TABLE OF CONTENTS

		Page
1.0	INTRODUCTION	1
	1.1 Structure of the NOAA/EDIS/NGSDC Tapes	1
	1.1.1 Record Length	3
	1.1.2 File Structure	6
2.0	BUILDING RANDOM ACCESS FILES	8
	2.1 Introduction	8
	2.2 Method	8
3.0	USERS GUIDE FOR OBTAINING DATA FROM RANDOM ACCESS FILES FOR A GIVEN ANALYSIS AREA	29
	3.1 STEP 1: Determine the limits of the desire analysis area	30
	3.1.1 Identify Beginning and Ending Latitudes and Longitudes	30
	3.1.2 Converting Longitude and Latitude to Beginning and Ending Record and Word Numbers	32
	3.2 STEP 2: Pull the desired random access file(s) from tape and place on a direct access file on the user account	34
	3.3 STEP 3: Pull file generation support routines from tape A0320	35
	3.4 STEP 4: Modify Support Routines SUBGEN and GENFIL to identify the desired area	36
	3.5 STEP 5: Submit SUBGEN	42
	3.6 STEP 6: Merging portions of data extracted from RANELV3 and RANELV4	42

LIST OF TABLES

Table		Page
1.1	Four tapes containing the elevation data for the continental United States at 30-second grid intervals as stored on the Colorado State University Tape Library .	2
2.1	First 50 lines of SEARCH output for the westernmost section of the United States	13
2.2	Condensed version of the SEARCH output for the westernmost section of the United States	15

LIST OF FIGURES

Figure		Page
1.1	Listing of the first record of tape VSN=A2968	4
1.2	Schematic of a tape record	5
1.3	Schematic of arrangement of records on tape	7
2.1	Random access file organization for the westernmost portion of the United States	9
2.2	List of the source code for program SEARCH	10
2.3	Submit file used to execute program SEARCH	12
2.4	List of the source code for program BLNKBLK, which creates the missing data file BLNKFIL for 1 degree of longitude	17
2.5	Submit file used to fill the gaps in the original coded data file	18
2.6	Source code listing of program INIT	21
2.7	Listing of the submit file used to run program INIT	22
2.8	Source code list of program ELEVORG	24
2.9	Listing of the submit file used to run program ELEVORG	28
3.1	Representation of example analysis area	31
3.2	Batch TATS process to retrieve elevation file generation support routines	36
3.3	GENFIL showing parameter which must be changed to configure program to select data from user selected file	37
3.4	GENFIL for extracting data from RANELV3 for the eastern portion of the example analysis area	38
3.5	GENFILE for extracting data from RANELV4 for the western portion of the example analysis area	39
3.6	Changes that must be made in SUBGEN for each analysis area	40

LIST OF FIGURES
(Continued)

Figure		Page
3.7	SUBGEN for extracting data via GENFIL from RANELV3 for the eastern portion of the example analysis area .	41
3.8	SUBGEN for extracting data via GENFIL from RANELV4 for the western portion of the example analysis area .	41
3.9	Listing of MERGELV	44
3.10	Listing of MERGSUB (the submit file for MERGELV) . . .	45

1.0 INTRODUCTION

The Topographic Air Pollution Analysis System (TAPAS) (Childs and Marlatt, 1981) is designed to support wind and air quality modeling in complex terrain. Digital files of terrain are required as inputs to TAPAS.

The sources of digital terrain data that have been used include: Defense Mapping Agency Digital Terrain Tapes (available directly from the U.S. Forest Service Library of DMA tapes, the Topographic Analysis System -- TOPAS (USDA, 1976); manual digitization of USGS or other contour maps; U.S. Department of Commerce NOAA/EDIS/NGSDC 30-second average elevation data for the conterminous U.S.

This users guide is designed to assist the user in selecting and extracting data from the NOAA/EDIS/NGSDC 30-second average elevation tapes. The guide assumes that the user is familiar with the operating system, editing routines and other utility functions as implemented on the Colorado State University's CDC 720 computers (NOS 1.4, Level 552).

1.1 Structure of the NOAA/EDIS/NGSDC Tapes

Four elevation data types covering the continental U.S. were obtained from:

U.S. DEPARTMENT OF COMMERCE
NOAA, Environmental Data Information Service
National Geophysical and Solar-Terrestrial Data Center (D62)
325 Broadway
Boulder, CO 80303
Telephone: (303) 497-6120

The tapes exist in the C.S.U. computer tape library as the following tape numbers (see Table 1.1) and under the password "MARLATT".

Each tape contains all data within a given latitude band, but the limits of the latitude band vary with each tape. The maximum data band (A2968) contains data from 28°00'00"north latitude to 49°59'30" north latitude.

The tapes are organized into records with each record containing elevation values (in meters above MSL) for every 30 second latitude by

Table 1.1 Four tapes containing the elevation data for the continental United States at 30-second grid intervals as stored on the Colorado State University Tape Library

RAW ELEVATION FILES

NOAA/EDIS/NGSDC DATA TAPE CONTENT

TAPE NUMBER IN CSU LIBRARY (PW=MARLATT)

		A1383*	A2976*	A2968	A2969
LONGITUDE COVERAGE :	START	66°00'00"	88°00'00"	100°00'00"	109°00'00"
	STOP	87°59'30"	99°59'30"	108°59'30"	125°59'30"
LATITUDE COVERAGE :	START	28°00'00"	28°00'00"	28°00'00"	30°00'00"
	STOP	49°59'30"	49°59'30"	49°59'30"	49°59'30"
1 longitude				9°	17°
1 latitude				22°	20°
BLOCK SIZE - Nº RECORDS IN LATITUDE BLOCK (1° LATITUDE)		12	12	12	12
Nº RECORDS IN LONGITUDE BLOCK				9	17
TOTAL RECORDS/BLOCK				108	204
OBSERVATIONS PER BLOCK (Nº OF LONGITUDE VALUES PER LATITUDE VALUE)				1080 (9 × 120)	2040 (17 × 120)
Nº OF RECORDS IN RANDOM ACCESS FILE				2640 (120 × 22)	2400 (120 × 20)
NAME OF RANDOM ACCESS FILE				RANELV3	RANELV4
STORED ON TAPE (PW=MARLATT)				A0321	A0321

* FILES HAVE NOT YET BEEN PROCESSED
ALL PARAMETERS ARE TO BE DETERMINED

longitude interval within 1° longitude by 5 minutes latitude. For example, the first record of tape VSN=A?968 is listed in Figure 1.1 and is represented schematically in Figure 1.2.

1.1.1 Record Length

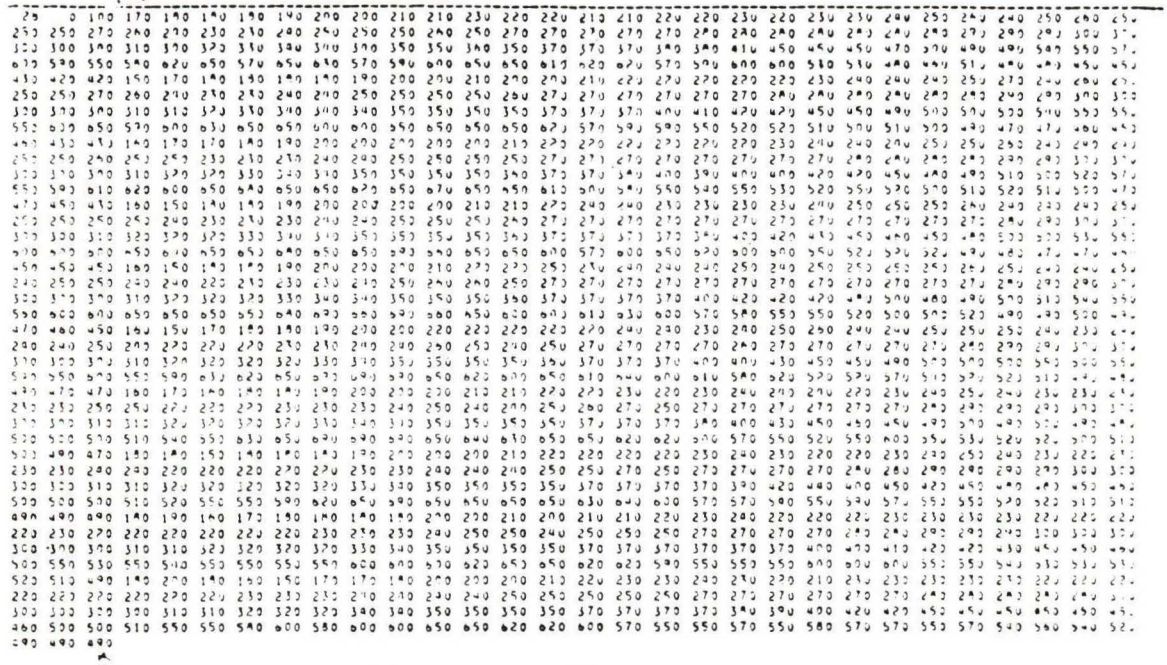
The following general information is characteristic of each record.

1. The first three integer values (12 characters long) are label information.
   - The first value is degrees of latitude (28° in Figure 1.1 example).
   - The second value is minutes of latitude (00' in Figure 1.1 example).
   - The third value is degrees of longitude representing the appropriate 1° longitudinal band 100°00'00" to 100°59'30").
2. Twelve hundred (1200) I4 elevation observations (in meters above mean sea level) follow the label information. The elevation observations begin at the southeast corner and end at the northwest corner of the portion of the topography they represent (see Figure 1.2). The elevation observations are at a grid spacing of 30" longitude and 30" latitude. In the Figure 1.1 example:
   - the first value 170 m is the elevation of point 100°00'00" W long. - 28°00'00" N lat.
   - the second value 180 m is the elevation of point 100°00'30" W long. - 28°00'00" N. lat.
   - the 120th value 420 m is the elevation of point 100°49'30" W long. - 28°00'00" N. lat.
   - the last value 490 m is the elevation of point 100°59'30" W long. - 28°04'30" N lat.

Figure 1.1 Listing of the first record of tape VSN=A2968

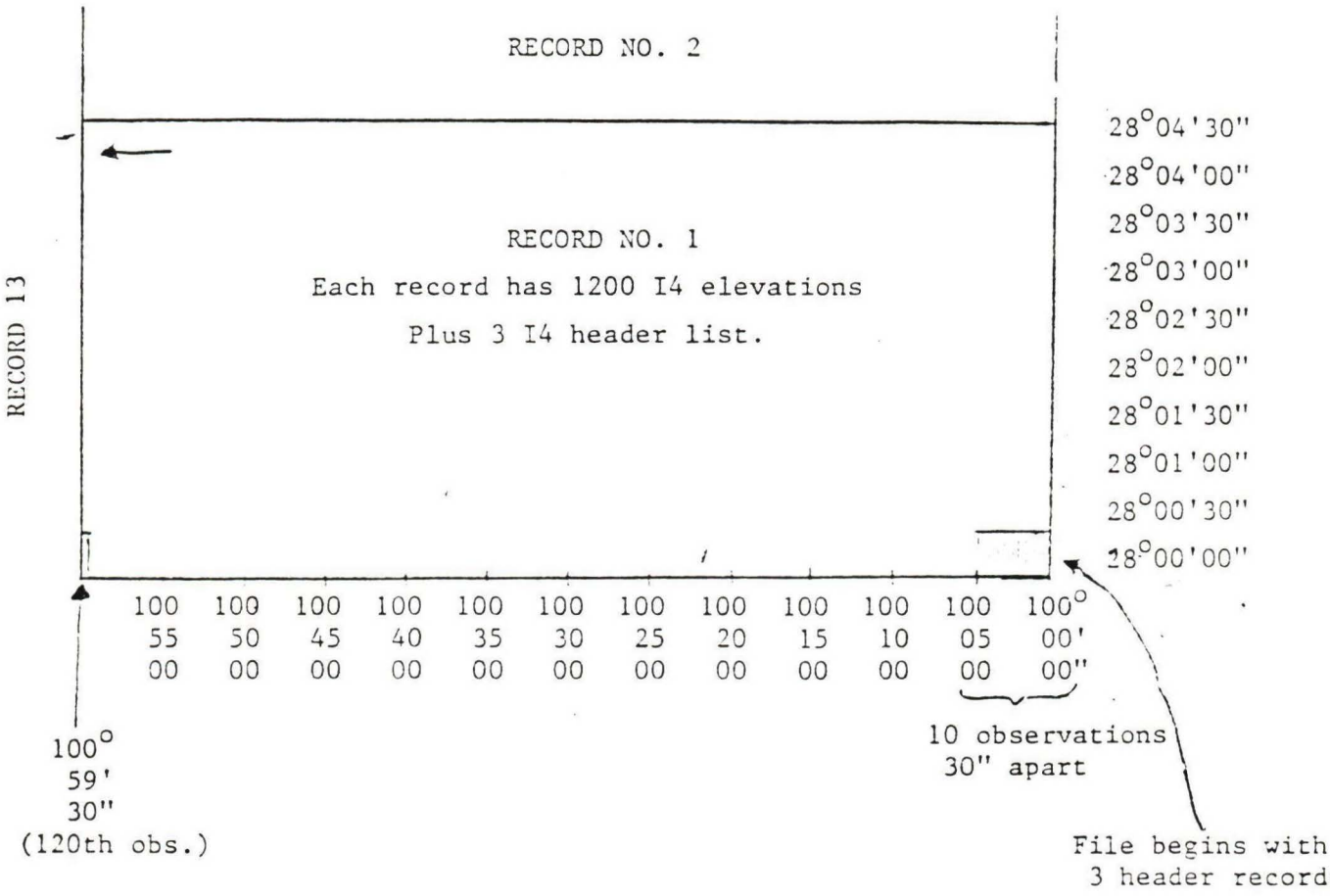
Heading 28°00' latitude, 100° longitude

1st elevation 170 m at location 28°00'00", 100°00'00"



Last elevation 28°04'30", 100°59'30"

Figure 1.2 Schematic of a tape record (Example: Record 1 of tape VSN=A2968)



Note that elevations begin at lowest longitude and latitude (lower right) and ends at highest longitude and latitude (upper left).

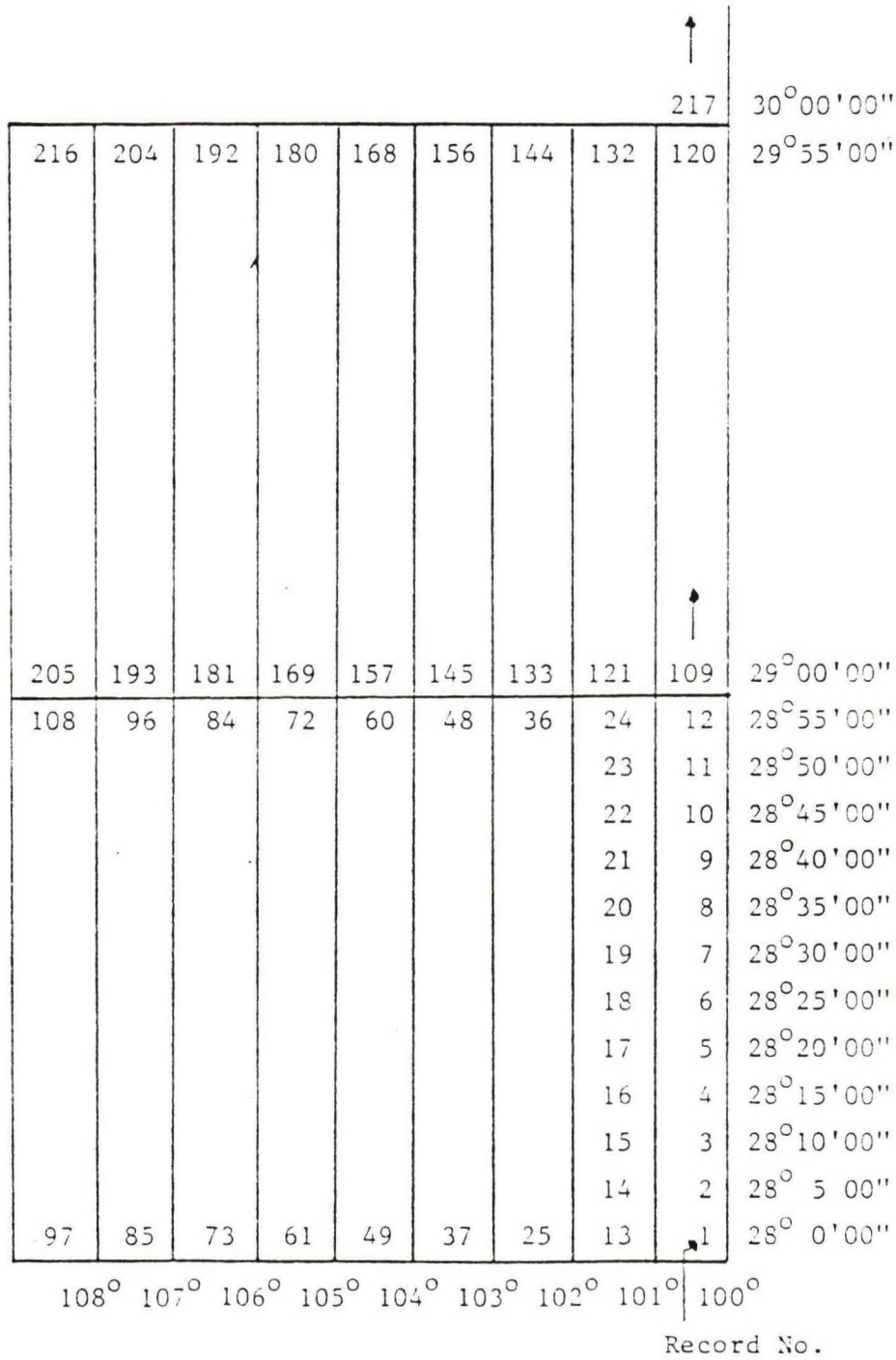
3. Each total record is:

   - 1203 I4 data values long.
   - 4812 characters long.

1.1.2 File Structure

Each tape contains a number of records. The records are arranged by 5 minutes latitude and several degrees longitude (depending on the longitudinal band coverage of each tape.) Figure 1-3 provides a schematic of the arrangement of records within tape A2968. For example, the user would have to find record 109 to access the elevation information for the area 29°00'00" - 29°04'30" N lat. by 100°00'00" - 100°59'30" W lat.

Figure 1.3 Schematic of arrangement of records on tape
(Example: Record arrangement on tape VSN=A2968)



2.0 BUILDING RANDOM ACCESS FILES

2.1 Introduction

The preceding discussion details how the original NOAA/EDIS/NCGDS data is stored on magnetic tape. This data is not in a form that is condusive to extracting a section based on latitude/longitude inputs. The purpose of this section is to describe how the information has been translated into the random access form which allows access by latitude/longitude.

The elevation data is organized into a multi-record random access file. The records are organized from west to east so that the first elevation on a record is the height of the western most longitude of the particular tape (for RANELV4 (original tape #A2966) this represents the elevation at 125°59'30"). The last elevation on a record is the height of the terrain at the eastern edge of the coverage (109°00'00" for tape A2969). Each record represents 30" of latitude; the first record is at the maximum latitude (49°59'30") the last record is minimum latitude (record #2400 latitude 30°00'00" for tape A2969). The organization of Tape A2969 is shown in Figure 2.1.

In this document, the term "record" will be used as the pointer into the random access file for a constant latitude. The term observation is used to define a longitude.

2.2 Method

The first step in converting the coded original tapes into the random access structure is to use program SEARCH to read the entire tape and print out the first 12 characters of each record (the latitude/longitude variables). This information can be used to identify missing data fields. A listing of program SEARCH is shown in Figure 2.2. An example submit

Figure 2.1 Random access file organization for the westernmost portion of the United States (original tape #A2969).

	LAT.	LONG.	OBS. 1	OBS. 2	...	OBS. 2039	OBS. 2040
Record 1	49°59'30"	125°50'30"	-999.99	-999.99		770.0	770.0
Record 2	49°59'00"	125°50'30"	-999.99	-999.99		770.00	770.0
Record 3	°	°	-999.99	-999.99		790.0	790.0
Record 4	°	°	-999.99	-999.99		780.0	760.0
Record 5	°	°	-999.99	-999.99		790.0	780.0
°	°	°	°	°		°	°
°	°	°	°	°		°	°
°	°	°	°	°		°	°
Record 2396	°	°	1480	1480		1480.0	1480.0
Record 2397	°	°	1500	1500		1500.0	1500.0
Record 2398	°	°	1280	1210		1280.0	1210.0
Record 2399	30°00'30"	123°50'30"	1130	1160		1130.0	1160.0
Record 2400	30°00'00"	125°50'30"	1070	1000		1070.0	1000.0

Figure 2.2 List of the source code for program SEARCH

```
      PROGRAM SEARCH (INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT,TAPE7)
C
C
C         THIS PROGRAM READS THE FIRST 3 VALUES FROM EACH RECORD
C     OF A NOAA/EDIS/NCGDS DAT FILE.
C
      INTEGER NUMREC
      PARAMETER (NUMREC = 5000)
      INTEGER RECCNT
       CHARACTER*4 LATDEG, LATMIN, LONG, DATA*4800
C
C
      OPEN (7,RECL=4812)
C
      DO 10 RECCNT = 1, NUMREC
          READ (7,'(3A4,A)') LATDEG, LATMIN, LONG, DATA
          WRITE (6,'(X,I5,3(2X,A4))') RECCNT,LATDEG,LATMIN,LONG
10    CONTINUE
      STOP
      END
```

file for program SEARCH is shown in Figure 2.3. The output from program SEARCH is approximately 55 pages in length. A listing of the first 50 lines of SEARCH results is shown in Table 2.1. Table 2.1 shows the organization of the data on the original data file and if it were continued, could be used as a reference to identify missing data fields. The output shown in Table 2.1 does not show any missing fields. Missing fields will only appear at the beginning or end of a latitude band. Table 2.2 is a condensed view of the SEARCH output.

As can be seen from Table 2.2, the maximum latitude bands is from 109° to 125° longitude. In order to generate the random access file, each latitude band in the file must be the same length. To make the latitude bands equal in length, additional data fields must be added to the file. This task can be accomplished through the operating system by copying blocks of data from the original to a new file and then adding additional data records. These additional data fields contain elevation values of 9999.99 to indicate missing data areas. The file 'BLNKFIL' holds 12 records of data (one degree longitude). Each data point in 'BLNKFIL' has a value of -999. [A copy of the program used to make BLNKFIL is shown in Figure 2.4.] The submit file used to patch the holes in the data file shown in Table 2.2 is shown in Figure 2.5.

Now that the data has been determined to be consistent and complete, the raw random access file can be created. The first step is to determine the total number of records and observations that will be in the random access file.

The number of records is determined by the following formula:

Figure 2.3 Submit file used to execute program SEARCH

```
/JOB
/PACK
/NOSEQ
BN09,T250,PR75. NOAA/EDIS/NGSDC DATA INSERTION.
/READ,USERNBR
RATE,BKG.
ROUTE,OUTPUT,DEF,DC=LP,ID=00.
ATTACH,TAPE7=ELE4.
GET,SEARCH.
FTN5,I=SEARCH,L=0,B=BIN,DB.
BIN.
SKIP,EXLAB.
EXIT.
ENDIF,EXLAB.
DAYFILE,L=JOEDAY.
REPLACE,JOEDAY.
REWIND,OUTPUT.
COPYEI,OUTPUT,SEROUT.
REPLACE,SEROUT.
/EOF
```

Table 2.1 First 50 lines of SEARCH output for the westernmost section of the United States

Sequence	Latitude		Longitude
Number	Degrees	Minutes	Degrees
1	30	0	109
2	30	5	109
3	30	10	109
4	30	15	109
5	30	20	109
6	30	25	109
7	30	30	109
8	30	35	109
9	30	40	109
10	30	45	109
11	30	50	109
12	30	55	109
13	30	0	110
14	30	5	110
15	30	10	110
16	30	15	110
17	30	20	110
18	30	25	110
19	30	30	110
20	30	35	110
21	30	40	110
22	30	45	110
23	30	50	110
24	30	55	110
25	30	0	111
26	30	5	111
27	30	10	111
28	30	15	111
29	30	20	111
30	30	25	111
31	30	30	111
32	30	35	111
33	30	40	111
34	30	45	111
35	30	50	111
36	30	55	111
37	30	0	112
38	30	5	112
39	30	10	112
40	30	15	112
41	30	20	112
42	30	25	112
43	30	30	112
44	30	35	112
45	30	40	112

Table 2.1 (continued)

Sequence	Latitude		Longitude
Number	Degrees	Minutes	Degrees
46	30	45	112
47	30	50	112
48	30	55	112
49	30	0	113
50	30	5	113

Table 2.2. Condensed version of the SEARCH output for the westernmost section of the United States.

Sequence	Latitude		Longitude
Number	Degrees	Minutes	Degrees
1	30		109
2	30	5	109
3	30	10	109
4	30	15	109
5	30	20	109
°	°	°	°
°	°	°	°
°	°	°	°
144	30	55	120
145	31	0	109
°	°	°	°
°	°	°	°
°	°	°	°
300	31	55	121
301	32	0	109
°	°	°	°
°	°	°	°
°	°	°	°
468	32	55	122
469	33	0	109
°	°	°	°
°	°	°	°
°	°	°	°
648	33	55	123
649	34	0	109
°	°	°	°
°	°	°	°
°	°	°	°
828	34	55	123
829	35	0	109
°	°	°	°
°	°	°	°
°	°	°	°
1020	35	55	124
1021	36	0	109
°	°	°	°
°	°	°	°
°	°	°	°
1224	36	55	125
1225	37	0	109

Table 2.2 (continued)

Sequence	Latitude		Longitude
Number	Degrees	Minutes	Degrees
°	°	°	°
°	°	°	°
°	°	°	°
1428	37	55	125
1429	38	0	109
°	°	°	°
°	°	°	°
°	°	°	°
1632	38	55	125
1633	39	0	109
°	°	°	°
°	°	°	°
°	°	°	°
1836	39	55	125
1837	40	0	109
°	°	°	°
°	°	°	°
°	°	°	°
2040	40	55	125
2041	41	0	109
°	°	°	°
°	°	°	°
°	°	°	°
2244	41	55	125
2245	42	0	109
°	°	°	°
°	°	°	°
°	°	°	°
2448	42	55	125
2449	43	0	109
°	°	°	°
°	°	°	°
°	°	°	°
2652	43	55	125
2653	44	0	109
°	°	°	°
°	°	°	°
°	°	°	°
3875	49	50	125

Figure 2.4 List of the source code for program BLNKBLK, which creates the missing data file BLNKFIL for 1 degree of longitude

```
      PROGRAM BLNKBLK (INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT,TAPE7)
C
C
C         THIS PROGRAM CREATES A 12 RECORD BLOCK OF MISSING DATA TO
C     BE USED TO FILL OUT THE MISSING PARTS OF A NOAA/EDIS/NGCDS DATA FILE.
C
       INTEGER RECCNT
       CHARACTER*4 LATDEG, LATMIN, LONG, DATA(1200)
      DATA LATDEG,LATMIN,LONG,DATA/1203('-999')/
C
C
      OPEN (7,RECL=4812)
C
      DO 10 RECCNT = 1, 12
          WRITE (7,'(1203A4)') LATDEG, LATMIN, LONG, DATA
        ENDFILE 7
10    CONTINUE
      STOP
      END
```

Figure 2.5 Submit file used to fill the gaps in the original coded data file

```
/JOB
/PACK
/NOSEQ
BN09,T200,PR50. ASSEMBLE THE MISSING DATA WITH THE NOAA/EDIS/NGSDC FILE.
/READ,USERNBR
ROUTE,OUTPUT,DEF,DC=LP,ID=00.
RATE,BKG.
ATTACH,ELE4.
DEFINE,ELE4FNL/M=W.
GET,BLNKFIL.
COPYBR,ELE4,ELE4FNL,144.
REWIND,BLNKFIL.
COPYBR,BLNKFIL,ELE4FNL,12.
REWIND,BLNKFIL.
COPYBR,BLNKFIL,ELE4FNL,12.
REWIND,BLNKFIL.
COPYBR,BLNKFIL,ELE4FNL,12.
REWIND,BLNKFIL.
COPYBR,BLNKFIL,ELE4FNL,12.
REWIND,BLNKFIL.
COPYBR,BLNKFIL,ELE4FNL,12.
COPYBR,ELE4,ELE4FNL,156.
REWIND,BLNKFIL.
COPYBR,BLNKFIL,ELE4FNL,12.
REWIND,BLNKFIL.
COPYBR,BLNKFIL,ELE4FNL,12.
REWIND,BLNKFIL.
COPYBR,BLNKFIL,ELE4FNL,12.
REWIND,BLNKFIL.
COPYBR,BLNKFIL,ELE4FNL,12.
COPYBR,ELE4,ELE4FNL,168.
REWIND,BLNKFIL.
COPYBR,BLNKFIL,ELE4FNL,12.
REWIND,BLNKFIL.
COPYBR,BLNKFIL,ELE4FNL,12.
REWIND,BLNKFIL.
COPYBR,BLNKFIL,ELE4FNL,12.
COPYBR,ELE4,ELE4FNL,180.
REWIND,BLNKFIL.
COPYBR,BLNKFIL,ELE4FNL,12.
REWIND,BLNKFIL.
COPYBR,BLNKFIL,ELE4FNL,12.
COPYBR,ELE4,ELE4FNL,180.
REWIND,BLNKFIL.
COPYBR,BLNKFIL,ELE4FNL,12.
REWIND,BLNKFIL.
COPYBR,BLNKFIL,ELE4FNL,12.
COPYBR,ELE4,ELE4FNL,192.
REWIND,BLNKFIL.
COPYBR,BLNKFIL,ELE4FNL,12.
```

Figure 2.5 (continued)

```
COPYEI,ELE4,ELE4FNL.
SKIP,EXLAB.
EXIT.
ENDIF,EXLAB.
DAYFILE,L=JOEDAY.
REPLACE,JOEDAY.
/EOF
```

Number Records = ((Maximum Latitude + 30") - Minimum Latitude) *
120 obs/degree

For the example area the equation is

Number Records = ((49°59'30" + 30") - 30°) * 120

= (50° - 30°) * 120

= 20° * 120 = 2400

The number of observations per record is determined by the following formula:

Number Observations = ((West Longitude border + 30") -
East Longitude border) * 120 obs/degree + 2

for the example area the equation is

Number Observations = ((125°59'30" - 30") - 109°) * 120 + 2

= (126° - 109°) * 120 + 2

= (17°) * 120 + 2 = 2040 + 2 = 2042

The additional two observations are added because the latitude and longitude degrees are put at the beginning of each record. Once the parameters on Records and Observations are determined the next step is to initialize a blank random access file of the appropriate size. This is accomplished by using the INIT program shown in Figure 2.6. A submit file for program INIT is shown in Figure 2.7.

The final step in creating the random access data base is to read the elevations in from the completed coded file and write the information to the random access file.

Figure 2.6 Source code listing of program INIT

```
      PROGRAM INIT (INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT,TAPE8)
C
C
C       THIS PROGRAM INITIALIZES A RANDOM ACCESS FILE TO MISSING
C       VALUES (-999.99).  THE FILE HAS THE FOLLOWING PARAMETERS:
C
C            RECORD LENGTH  -  RECLEN WORDS (NUMOBS + 2 (LAT; LONG))
C        NUMBER OF RECORDS  -  NUMREC
C
C        THE PROGRAM WAS DESIGNED AS A UTILITY PROCEDURE FOR
C        PUTTING NOAA/EDIS/NGSDC ELEVATION TAPES INTO A READILY
C        ACCESSABLE FORM.
C         (REFERENCE:  USERS GUIDE TO NOAA/EDIS/NGSDC AVERAGE
C          TERRAIN DATA OF THE CONTERMINOUS UNITED STATES FOR
C          TAPAS APPLICATIONS, APRIL 1982  DAVID DIETRICH)
C
C         PROGRAMMER  JOSEPH E. CHILDS
C                     APRIL 15, 1982
C
C         COPYRIGHT  1982  APCOMP, INC.
C
      INTEGER RECLEN, NUMREC
      PARAMETER (RECLEN = 2042, NUMREC =2400)
      REAL RECORD (RECLEN)
      DATA RECORD/RECLEN(-999.99)/
C
C
C-----------------------------------------------------------------------
C
      OPEN (8,IOSTAT=IOS,ERR=700,ACCESS='DIRECT',FORM='UNFORMATTED',
     *      RECL=RECLEN)
C
      DO 10  I=1, NUMREC
            WRITE(8,IOSTAT=IOS,ERR=705,REC=I) RECORD
 10   CONTINUE
C
      STOP 'SUCCESSFUL TERMINATION'
C
 705  WRITE(6,*) 'ERROR NUMBER',IOS,' ENCOUNTERED AT RECORD',I,
     *           'PROGRAM TERMINATES - FILE NOT PROPERLY STORED'
C
      STOP 'ERROR WRITE'
 700  WRITE(6,*) 'ERROR NUMBER',IOS,'DURING INITIAL OPEN - FILE NOT
     *            PROPERLY STORED.'
C
      STOP 'OPEN ERROR'
      END
```

Figure 2.7 Listing of the submit file used to run program INIT

```
/JOB
/PACK
/NOSEQ
BN09,T250,PR30. NOAA/EDIS/NGSDC FILE INITIALIZATION.
/READ,USERNBR
RATE,BKG.
ROUTE,OUTPUT,DEF,DC=LP,ID=00.
DEFINE,TAPE8=BACKUP.
GET,INIT.
FTN5,I=INIT,LO,B=BIN,OPT=2.
BIN.
SKIP,EXLAB.
EXIT.
ENDIF,EXLAB.
DAYFILE,L=JOEDAY.
REPLACE,JOEDAY.
REWIND,OUTPUT.
COPYEI,OUTPUT,INITOUT.
REPLACE,INITOUT.
/EOF
```

Program ELEVORG shown in Figure 2.8 is the algorithm which organizes the elevations and writes them to the random access file. The submit file for ELEVORG is shown in Figure 2.9 The execution time required for the creation of the random access file from the coded information is 3,000 seconds. The resultant file size is approximately 77,000 PRU's (a PRU is 64 words).

Figure 2.8 Source code list of program ELEVORG

```
      PROGRAM ELEVORG (INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT,TAPE7,
     *        TAPE8)
C
C
C             ******** ELEVATION ORGANIZE ********
C
C         THIS PROGRAM TAKES ELEVATION DATA FORMATTED IN THE FORM SUPPLIED
C      BY THE **NOAA MAGNETIC TAPES AND REFORMATES THE DATA
C      INTO A MORE CONVIENT STRUCTURE.  THE ORIGINAL DATA FORMAT IS
C      DESCRIBES IN THE MANUAL ENTITLED "USERS GUIDE TO **NOAA
C      AVERAGE TERRAIN DATA" BY DAVID DIETRICH, APRIL 1982.
C
C         PROGRAMMER     JOSEPH E. CHILDS
C                        APRIL 18, 1982
C
C
C         COPYRIGHT 1982 APCOMP INC.
C
C       FILE DESCRIPTIONS:
C           TAPE7 - ORIGINAL **NOAA DATA FILE
C         TAPE8 - RANDOM ACCESS FILE INITIALIZED TO -999.99 (SEE PROGRAM INIT).
C
C
C      PARAMENTERS:
C             THE FOLLOWING PARAMETERS MUST BE CHANGED TO MATCH THE SIZE
C         CHACTERISTICS OF THE TAPE BEING CONVERTED.
C
C             XRECLEN - NUMBER OF OBSERVATIONS FROM INITIAL LONGITUDE
C                           TO FINAL LONGITUDE.
C
C             NUMRECY - NUMBER OF OBSERVATIONS FROM INITIAL LATITUDE
C                           TO FINAL LATITUDE.
C
C             BLKSIZ  - NUMBER OF RECORDS PER BLOCK.
C
C
C      ASSUMPTIONS:
C         1.  THE DIMENSIONS OF A BLOCK IS 12 RECORDS IN THE Y DIRECTION,
C               BLKSIZ/12 RECORDS IN THE X DIRECTION IN THE ORIGINAL
C               NOAA/EDIS/NGSDC DATA TAPE.
C
C         2.  THERE ARE 10 OBSERVATIONS IN THE Y DIRECTION FOR EVERY
C               RECORD IN THE ORIGINAL NOAA/EDIS/NGSDC DATA TAPE.
C
C         3.  THERE ARE 120 OBSERVATIONS IN THE X DIRECTION PER RECORD
C               (I.E. 10* 120 = 1200 OBSERVATIONS PER RECORD) IN THE
C               ORIGINAL NOAA/EDIS/NGSDC DATA FILE.
C
C         4.  EACH RECORD IS PRECEEDED BY 3I4 LATTITUDE/LONGITUDE
C               DESCRIPTORS IN THE ORIGINAL NOAA/EDIS/NGSDC
C               DATA FILE.
C
```

Figure 2.8 (continued)

```
C          5.  EACH FIELD IN THE ORIGINAL NOAA/EDIS/NGSDC
C                   DATA FILE IS 4 CHARACTERS LONG.
C
C
      INTEGER XRECLEN, NUMRECY, BLKSIZ
C
C          ********* THE FOLLOWING VALUES MUST BE CHANGED FOR EACH
C                    DAT RUN OF THIS MODEL **********.
C
      PARAMETER (XRECLEN =2040, NUMRECY = 2400, BLKSIZ = 204)
C
C
      REAL RANREC (XRECLEN), SEQREC(120,10)
      INTEGER XLEF, XRIG, YBOT, YTOP, YBLOCK
C
C
      OPEN (7,IOSTAT=IOS,ERR=700,RECL=4812)
      OPEN (8,IOSTAT=IOS,ERR=700,ACCESS='DIRECT',FORM='UNFORMATTED',
     *            RECL=XRECLEN+2)
C
C
C-------------------------------------------------------------C
C
C            THIS LOOP DESCRIBES EACH BLOCK ACCESS.
      DO 200 YBLOCK = NUMRECY, 1, -120
C
C
C              THIS LOOP DESCRIBES THE PATH ACROSS A BLOCK.
           DO 100 XRIG = XRECLEN, 1, -120
                XLEF = XRIG - 119
C
C
C                    THIS LOOP DESCRIBES 1 ASSENT UP A BLOCK.
              DO 50 YBOT = YBLOCK, YBLOCK-119, -10
                    YTOP = YBOT - 9
C
C
                CALL DATRANS (SEQREC,RANREC,XLEF,XRIG,YBOT,YTOP,XRECLEN)
C
C
50              CONTINUE
C
C
100        CONTINUE
C
C
200   CONTINUE
C
      WRITE (6,*) ' FINAL VARIABLE STATES. '
      WRITE (6,*) ' YBLOCK ',YBLOCK
      WRITE (6,*) ' XRIG ',XRIG,'     XLEF ',XLEF
      WRITE (6,*) ' YBOT ',YBOT,'     YTOP ',YTOP
```

Figure 2.8 (continued)

```
      STOP 'ALL LOOPS PROCESSED'
  700     WRITE (6,*) ' ERROR ON FILE OPEN. ',IOS
      END
      SUBROUTINE DATRANS (SEQREC, RANREC, XLEF, XRIG, YBOT, YTOP,
     *                    XRECLEN)
C
C
C                  ******  DATA TRANSFER  ******
C
C         THIS ROUTINE TRANSFERS 1 RECORD OF DATA FROM THE ORIGINAL
C     NOAA/EDIS/NGSDC DATA FILE THE 10 PARTIAL RANDOM
C     ACCESS RECORDS.  THE DATA IS SWITCHED SO THAT IT CAN BE
C     INDEXED FROM UPPER-LEFT TO LOWER RIGHT.
C
C         PROGRAMMER: JOSEPH E. CHILDS
C                     APRIL 18, 1982
C
C         COPYRIGHT 1982 APCOMP INC.
C
      REAL LAT, LONG, RANREC(XRECLEN)
      REAL LATDEG,LATMIN,LONGSEQ, SEQREC(XLEF:XRIG,YTOP:YBOT), LATSUM
      INTEGER XLEF, XRIG, YBOT, YTOP, XRECLEN
C
C
C-----------------------------------------------------------------C
C
C         GET 1 RECORD OF DATA FROM THE ORIGINAL NOAA/EDIS/NGSDC
C         DATA FILE.
      READ (7,'(1203F4.0)',ERR=997,IOSTAT=IOS) LATDEG,LATMIN,LONGSEQ
     *              ,((SEQREC(I,J),I=XRIG,XLEF,-1),J=YBOT,YTOP,-1)
C
C
C             BREAK ORIGINAL RECORD INTO 10 PARTIAL RECORDS
       DO 10 IREC = YTOP, YBOT
         READ (8,ERR=998,IOSTAT=IOS,REC=IREC) LAT,LONG,RANREC
C
C              CHECK FOR RECORD ALREADY FILLED WITH DATA.
          IF(RANREC(XLEF).NE.-999.99 .OR. RANREC(XRIG).NE.-999.99)THEN
               WRITE (6,*)' RECORD HAS BEEN PREVIOUSLY FILLED WITH DATA'
                  GO TO 5000
             ENDIF
C
C
         LATSUM = LATDEG * 100 + LATMIN
C
C             CHECK FOR WRONG INDEXING INTO RECORDS
             IF (LAT .EQ. -999.99) THEN
                 LAT = LATSUM
                 LONG = LONGSEQ
             ELSE IF (LAT .NE. LATSUM .AND. LATDEG .NE. -999. ) THEN
             WRITE (6,*)' INDEXING ERROR  LATITUDE DOES NOT MATCH.'
             GO TO 5000
```

Figure 2.8 (continued)

```
            ENDIF
C
C
          DO 5 I = XLEF, XRIG
              RANREC(I) = SEQREC(I,IREC)
5         CONTINUE
C
          WRITE (8,ERR=999,IOSTAT=IOS,REC=IREC) LAT, LONG, RANREC
C
10    CONTINUE
      RETURN
C
C
C                        ERROR PROCESSING
C
997   WRITE (6,*) 'SEQUENTIAL FILE READ ERROR NUMBER ',IOS
      GO TO 5000
998   WRITE (6,*) ' RANDOM FILE READ ERROR NUMBER ',IOS
      GO TO 5000
999   WRITE (6,*) ' RANDOM FILE WRITE ERROR NUMBER ', IOS
C
C
5000  CONTINUE
      WRITE (6,601) XLEF,XRIG,YBOT,YTOP,XRECLEN,LAT,LONG
     *              ,LATDEG, LATMIN, LONGSEQ, LATSUM, IREC
601   FORMAT (T10,'XLEF AND XRIG ',I6,I6,'YBOT AND YTOP ',2I6,
     * '  XRECLEN ',I6,/,T20,'LAT AND LONG FROM RANDOM ',2F9.2,
     * '  LAT AND LONG FROM SEQUENTIAL ',4F9.2,/,
     *T20,'  CURRENT RECORD ',I6)
C
      DO 5555 K = YTOP, YBOT
          WRITE (6,603) (SEQREC(L,K),L=XLEF, XRIG)
5555  CONTINUE
603   FORMAT (' ',13(F9.2,1X))
C
C
          WRITE (6,'(///,A)')  'RAN REC'
          WRITE (6,605) RANREC
605   FORMAT (' ',13(F9.2,1X))
      X = -1
      Y = SQRT(X)
      STOP
      END
```

Figure 2.9 Listing of the submit file used to run program ELEVORG

```
/JOB
/PACK
/NOSEQ
BN09,T5000,PR30. NOAA/EDIS/NGSDC DATA INSERTION.
/READ,USERNBR
RATE,BKG.
ROUTE,OUTPUT,DEF,DC=LP,ID=00.
ATTACH,BACKUP.
DEFINE,TAPE8=RANELV4/M=W.
COPYEI,BACKUP,TAPE8.
ATTACH,TAPE7=ELE4FNL.
GET,ELEVORG.
FTN5,I=ELEVORG,LO,B=BIN,DB.
BIN.
SKIP,EXLAB.
EXIT.
ENDIF,EXLAB.
DAYFILE,L=JOEDAY.
REPLACE,JOEDAY.
REWIND,OUTPUT.
COPYEI,OUTPUT,GENOUT.
REPLACE,GENOUT.
/EOF
```

3.0 USERS GUIDE FOR OBTAINING DATA FROM RANDOM ACCESS FILES FOR A GIVEN ANALYSIS AREA

Data for the western U.S. exist on two random access files on tape A0321 under the password Marlatt (generated under user FYRY2A2).

RANDOM ACCESS ELEVATION FILES
FOR THE WESTERN UNITED STATES

		RANDOM ACCESS FILE NAMES/CONTENTS	
		RANELV3	RANELV4
LONGITUDE:	START	100°00'00"	109°00'00"
COVERAGE	STOP	108°59'30"	125°59'30"
LATITUDE:	START	28°00'00"	30°00'00"
COVERAGE	STOP	49°59'30"	49°59'30"
RECORD LENGTH		1080	2040
NUMBER OF RECORDS		2640	2400

The procedure for obtaining data from these files for a given analysis area is a five step process if all data exists within one file, or a six step process if the required area is partially within two files. The steps are:

Step 1: Determine the limits of the desired analysis area

- identify beginning and ending longitudes and latitudes
- determine increment of the data (i.e. 30", 1', etc.)
- convert latitude and longitude to beginning and ending record numbers and word numbers.

Step 2: Pull the required random access file(s) (RANELV3 or RANELV4) from tape and place them on a direct access file on the user account.

Step 3: Pull file generation support routines from Tape A0320 (password - Marlatt) using the TATS fetch routine. The needed routines are GENFIL and SUBGEN (MERGEVL and MERGSUB must also be pulled if a portion of the analysis area exists within two files).

Step 4: Modify support routines SUBGEN and GENFIL to identify the desired analysis area.

Step 5: Submit SUBGEN. This routine will access the data and generate a file of the desired analysis area.

Step 6: Only to be used if a portion of the analysis area exists on two files. The program MERGELV is used to merge the two extracted portions of the analysis area into a single file.

A step by step example of the data acquisition procedure is outlined below for a hypothetical analysis area.

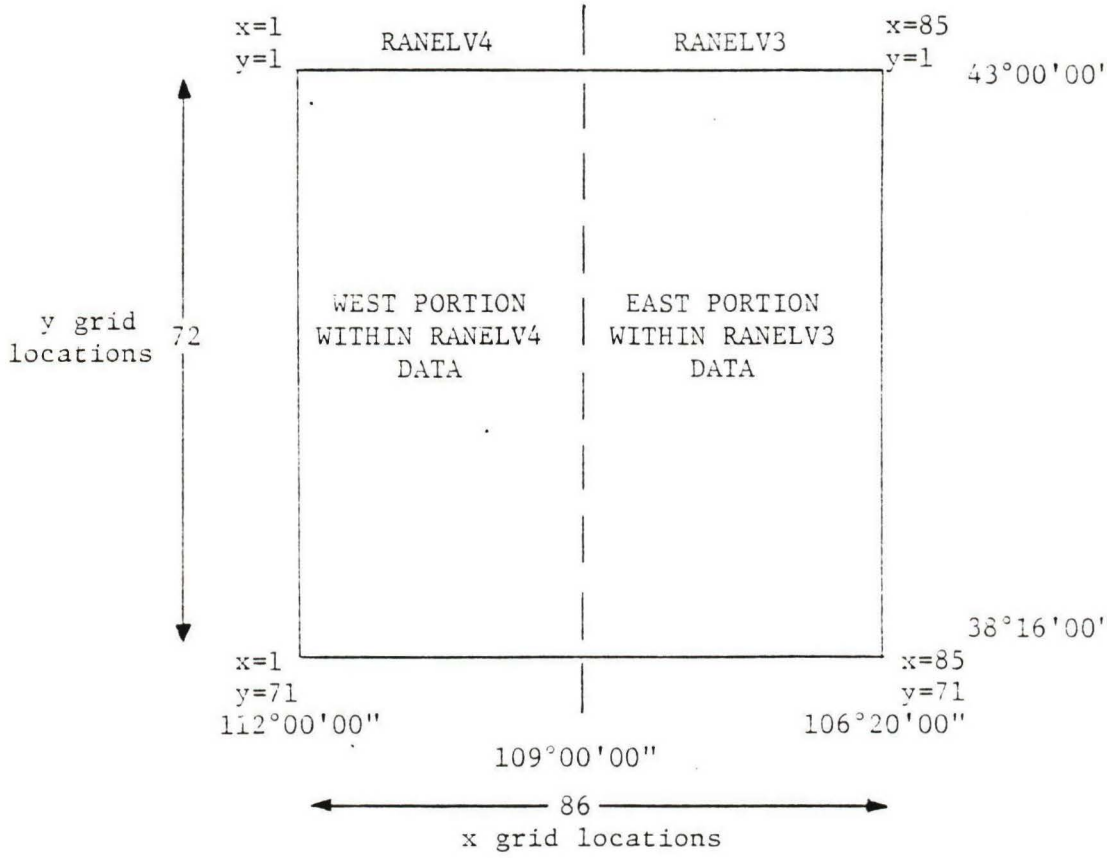
3.1 STEP 1 Determine the limits of the desired analysis area

3.1.1 Identify Beginning and Ending Latitudes and Longitudes

The size of the example analysis area is presented in Figure 3.1. Note that the area crosses the random access file boundary and will require the aquisition of data from both RANELV3 and RANELV4 and the merging of these data.

A four minute increment (every eight 30" value) in the x (longitude) and y (latitude) was chosen for this example.

Figure 3.1 Representation of example analysis area



3.1.2 Converting Longitude and Latitude to Beginning and Ending Record and Word Numbers

To determine the record number locations of the data within the random access files the following equation is applied.

RECNUM = [(max degree - user degree) * 120] + [(60 - user minute) * 2] - [1 if 30" value].

For the example analysis area, the beginning record number (location in the y coordinate) for both the RANELV 3 and RANELV 4 files is

$$RECNUM_B = [(49 - 43) * 120] + [(60 - 00) * 2]$$
$$= [720 + 120)]$$
$$= 840$$

The ending record number is:

$$RECNUM_E = [(49-38) * 120] + [(60 - 16) * 2]$$
$$= [1320 + 88]$$
$$= 1408.$$

To determine the location and number of words (elevation values in a row, the x coordinates values) use the same equation substituting in the longitude values.

For the portion of the analysis area in RANELV 3 (the eastern portion), the beginning location on the X will be:

$$WORDNUM_{B_E} = [(108 - 108) * 120] + [(60 - 59) * 2] - 1$$
$$= 1$$

the ending location would be

$$WORDNUM_{E_E} = [(108 - 106) * 120] + [(60 - 20) * 2]$$
$$= [240 + 80]$$
$$= 320.$$

For the portion of the analysis area in RANELV 4 (the west portion): the beginning location will be:

$$WORDNUM_{B_W} = [(125 - 112) * 120] + [(60 - 0) * 2]$$
$$= 1680$$

the ending location:

$$WORDNUM_{E_W} = [(125 - 109) * 120] + [(60 - 0) * 2]$$
$$= 2040.$$

To determine the actual number of grid points in the x and y directions use the formula below, truncating the result of the division.

$$NUMGRID = \frac{RECNUM_E - RECNUM_B}{INCREMENT} + 1.$$

For the Y direction in the example analysis area:

$$NUMGRID\ Y = \frac{1408 - 840}{8} + 1$$

$$NUMGRID\ Y = 72.$$

For the X direction we must consider both the east and west portions of the analysis area:

$$NUMGRID_{X(EAST)} = \frac{320 - 1}{8} + 1 = 40.875$$

$$NUMGRID_{X(EAST)} = 40$$

$$NUMGRID_{X(west)} = \frac{2040 - 1680}{8} + 1 = 46$$

$$NUMGRID_{X(west)} = 46$$

$$TOTAL\ NUMGRID_X = 86.$$

The result of these calculations indicates that the size of the final elevation grid will be

$$x = 86$$

$$y = 72$$

with the distance between each grid point in the example area equal to 4' latitude and longitude.

To determine the approximate ground distance of a grid point in the x and y dimensions (in kilometers), apply the following equations:

distance between grid points in the x (° longitude direction);

Distance = (increment)(0.9265 km/30" at equator)[cos(latitude in degrees)]

i.e. at 45°N latitude for an 8 increment (4')

Distance = 5.241 km

distance between grid points in the y direction

(increment)(0.9265)

i.e. at any degree for an 8 increment (4')

Distance = 7.412 .

3.2 STEP 2 Pull the desired random access file(s) from tape and place on a direct access file on the user account

Procedure files (PROCFIL, APCOMP, Inc., 1981) have been developed to assist in data retrieval. The procedure files used to obtain the data from the random access digital library tapes is GETFILE. For directions on how to apply GETFILE use the command:

-help,,getfile

The result of this command will be the following listing:

```
.PROC,GETFILE,FILES,TAPEID,PASS,DENS,TRACKS,ACCT.
.*
.*      THIS PROCEDURE WILL RETRIEV A FILE FROM TAPE THAT IS IN
.*           UDUMPIT/ULOADIT FORMAT.
.*
.*     FILES = THE NAME(S) OF THE FILE(S) YOU WISH RETRIEVED.
.*             NOTE:  UP TO 4 FILES MAY BE RETRIEVED AT ONCE BY
.*                    ENCLOSING A LIST WITHIN THE DELIMITER "$"
.*                   EXAMPLE:  $FILE1,FILE2,FILE3,FILE4,FILE5$
.*     TAPEID = THE CSU TAPE NUMBER (VSN).
.*     PASS = THE TAPE PASSWORD.
.*     DENS = THE TAPE DENSITY (800,1600,6250).
.*     TRACKS = THE NUMBER OF TRACKS (MT=7-TRACK; NT = 9-TRACK)
.*     ACCT = THE USER ACCOUNT NUMBER THAT THE FILE WAS DUMPED FROM.
.*          NOTE:  THE ACCOUNT NUMBER MUST BE ENCLOSED IN "$"'S.
.*
.*            EXAMPLE:  $CCCLE**$
.*
.*--*.
```

Applying these directions, both RANELV3 and RANELV4 can be simultaneously retrieved. The procedure file command for accessing RANELV3 and RANELV 4 simultaneously will be:

```
- GETFILE,,$RANELV3,RANELV4$,A0321,MARLATT,6250,NT,$FYRY2A2$
```

This procedure will place the entire contents on RANELV3 and RANELV4 on direct access files on the users account. These files are very long and will cost a fair amount to store on the user account, therefore they should be purged from the user account as soon as possible after the desired data has been successfully extracted.

3.3 STEP 3 Pull file generation support routines from tape A0320

File generation support routines that exist on tape A0320 include:

GENFIL - program to extract desired data and generate a direct access file

SUBGEN - submit file for GENFIL

MERGELV - program to merge data from 2 elevation files

MERGSUB - submit file for the merge program

All of these files are stored in TATS format. To retrieve the files use the following batch process submit routine as illustrated in Figure 3.2.

Figure 3.2 Batch TATS process to retrieve elevation file generation support routines

```
/JOB
/PACK
/NOSEQ
DD77,T500,PR50. DIETRICH
USER,FYRY2A2,TAP1.
ROUTE,OUTPUT,DEF,DC=LP,ID=00.
GET,PROCFIL=TATS.
BEGIN,FETCH,,GENFIL,VSN=A0320,PASSWOR=MARLATT,JOBID=DD77,.
BEGIN,FETCH,,SUBGEN,VSN=A0320,PASSWOR=MARLATT,JOBID=DD77,.
BEGIN,FETCH,,MERGELV,VSN=A0320,PASSWOR=MARLATT,JOBID=DD77,.
BEGIN,FETCH,,MERGSUB,VSN=A0320,PASSWOR=MARLATT,JOBID=DD77,.
PUR.
EXIT.
CTIME.
STIME.
DAYFILE,L=TATSDAY.
REPLACE,TATSDAY.
/EOF
```

3.4 STEP 4 Modify Support Routines SUBGEN and GENFIL to identify the desired area

GENFIL is the program which extracts the desired data from the random access files that exist on the user account. The parameter in GENFIL which must be changed for each run are highlighted in Figure 3.3. The modified GENFIL routine that would be used to extract the east and west portions of the example analysis area are presented in Figures 3.4 and 3.5.

The submit file for GENFIL is SUBGEN. The parameters in SUBGEN which must be changed for each run are highlighted in Figure 3.6. The SUBGEN routines that would be used to extract the east and west portions of the example analysis area are presented in Figures 3.7 and 3.8.

Figure 3.3 GENFIL showing parameter which must be changed to configure program to select data from user selected file

```
      PROGRAM GENFIL (INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT,TAPE8,TAPE7)
C
C
C       THIS PROGRAM READS A RANDOM ACCESS FILE TO CHECK
C       FOR VALID DATA GENERATION.  THE FILE HAS THE FOLLOWING PARAMETERS:
C
C            RECORD LENGTH  -  RECLEN WORDS (NUMOBS  (DOES NOT
C                             INCLUDE THE LAT AND LONG PARAMETERS.  THE
C                              RECLEN PARAMETER IS THE NUMBER OF VALID
C                              ELEVATIONS PER RECORD.
C        NUMBER OF RECORDS  -  NUMREC
C
C        THE PROGRAM WAS DESIGNED AS A UTILITY PROCEDURE FOR
C        PUTTING NOAA/EDIS/NGSDC ELEVATION TAPES INTO A READILY
C        ACCESSABLE FORM.
C         (REFERENCE:  USERS GUIDE TO NOAA/EDIS/NGSDC AVERAGE
C          TERRAIN DATA OF THE CONTERMINOUS UNITED STATES FOR
C          TAPAS APPLICATIONS, APRIL 1982  DAVID DIETRICH)
C
C         PROGRAMMER  JOSEPH E. CHILDS
C                     APRIL 15, 1982
C
C         COPYRIGHT  1982  APCOMP, INC.
C
      INTEGER RECLEN, NUMREC
      PARAMETER (RECLEN = 1080, NUMREC =2640)
      REAL RECORD (RECLEN)
       INTEGER RECSTRT, RECEND, RECINC, OBSTRT, OBSEND, OBSINC
```

For RANELV3: RECLEN=1080, NUMREC=2640
For RANELV4: RECLEN=2040, NUMREC=2400

```
C
C
C-----------------------------------------------------------------------
C
      OPEN (8,IOSTAT=IOS,ERR=700,ACCESS='DIRECT',FORM='UNFORMATTED',
     *      RECL=RECLEN+2)
C
C
C            GET THE RECORD POINTERS FOR CHECKING THE DATA CONVERSION.
C
       READ (5,*) RECSTRT, RECEND, RECINC, OBSTRT, OBSEND, OBSINC
C
      DO 10  I=RECSTRT, RECEND, RECINC
            READ (8,IOSTAT=IOS,ERR=705,REC=I) LAT,LONG,RECORD
          WRITE(7,701) LAT, I, OBSTRT, OBSEND
          WRITE(7,703)  (RECORD(J),J=OBSTRT,OBSEND,OBSINC)
 10   CONTINUE
701    FORMAT ( ' LATITUDE ',F9.2,'   RECORD ',I5,
     *  '    OBSERVATION RANGE ',2I6)
703    FORMAT (13F9.2)
C
      STOP 'SUCCESSFUL TERMINATION'
C
 705  WRITE(6,*) 'ERROR NUMBER',IOS,' ENCOUNTERED AT RECORD',I,
     *           'PROGRAM TERMINATES - FILE READ ERROR'
C
      STOP 'ERROR READ'
 700  WRITE(6,*) 'ERROR NUMBER',IOS,'DURING INITIAL OPEN - FILE NOT
     *            PROPERLY STORED.'
C
      STOP 'OPEN ERROR'
      END
```

Figure 3.4 GENFIL For extracting data from RANELV3 for the eastern portion of the example analysis area

```
      PROGRAM GENFIL (INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT,TAPE8,TAPE7)
C
C
C       THIS PROGRAM READS A RANDOM ACCESS FILE TO CHECK
C       FOR VALID DATA GENERATION.  THE FILE HAS THE FOLLOWING PARAMETERS:
C
C            RECORD LENGTH  -  RECLEN WORDS (NUMOBS  (DOES NOT
C                             INCLUDE THE LAT AND LONG PARAMETERS.  THE
C                              RECLEN PARAMETER IS THE NUMBER OF VALID
C                              ELEVATIONS PER RECORD.
C        NUMBER OF RECORDS  -  NUMREC
C
C        THE PROGRAM WAS DESIGNED AS A UTILITY PROCEDURE FOR
C        PUTTING NOAA/EDIS/NGSDC ELEVATION TAPES INTO A READILY
C        ACCESSABLE FORM.
C         (REFERENCE:  USERS GUIDE TO NOAA/EDIS/NGSDC AVERAGE
C          TERRAIN DATA OF THE CONTERMINOUS UNITED STATES FOR
C          TAPAS APPLICATIONS, APRIL 1982  DAVID DIETRICH)
C
C         PROGRAMMER  JOSEPH E. CHILDS
C                     APRIL 15, 1982
C
C         COPYRIGHT  1982  APCOMP, INC.
C
      INTEGER RECLEN, NUMREC
      PARAMETER (RECLEN = 1080, NUMREC =2640)
      REAL RECORD (RECLEN)
       INTEGER RECSTRT, RECEND, RECINC, OBSTRT, OBSEND, OBSINC
C
C
C-----------------------------------------------------------------------
C
      OPEN (8,IOSTAT=IOS,ERR=700,ACCESS='DIRECT',FORM='UNFORMATTED',
     *      RECL=RECLEN+2)
C
C
C            GET THE RECORD POINTERS FOR CHECKING THE DATA CONVERSION.
C
       READ (5,*) RECSTRT, RECEND, RECINC, OBSTRT, OBSEND, OBSINC
C
      DO 10  I=RECSTRT, RECEND, RECINC
            READ (8,IOSTAT=IOS,ERR=705,REC=I) LAT,LONG,RECORD
          WRITE(7,701) LAT, I, OBSTRT, OBSEND
          WRITE(7,703)  (RECORD(J),J=OBSTRT,OBSEND,OBSINC)
 10   CONTINUE
701    FORMAT ( ' LATITUDE ',F9.2,'   RECORD ',I5,
     *  '    OBSERVATION RANGE ',2I6)
703    FORMAT (13F9.2)
C
      STOP 'SUCCESSFUL TERMINATION'
C
 705  WRITE(6,*) 'ERROR NUMBER',IOS,' ENCOUNTERED AT RECORD',I,
     *           'PROGRAM TERMINATES - FILE READ ERROR'
C
      STOP 'ERROR READ'
 700  WRITE(6,*) 'ERROR NUMBER',IOS,'DURING INITIAL OPEN - FILE NOT
     *            PROPERLY STORED.'
C
      STOP 'OPEN ERROR'
      END
```

Figure 3.5 GENFIL For extracting data from RANELV4 for the western portion of the example analysis area

```
      PROGRAM GENFIL (INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT,TAPE8,TAPE7)
C
C
C       THIS PROGRAM READS A RANDOM ACCESS FILE TO CHECK
C       FOR VALID DATA GENERATION.  THE FILE HAS THE FOLLOWING PARAMETERS:
C
C            RECORD LENGTH  -  RECLEN WORDS (NUMOBS  (DOES NOT
C                             INCLUDE THE LAT AND LONG PARAMETERS.  THE
C                              RECLEN PARAMETER IS THE NUMBER OF VALID
C                              ELEVATIONS PER RECORD.
C         NUMBER OF RECORDS  -  NUMREC
C
C         THE PROGRAM WAS DESIGNED AS A UTILITY PROCEDURE FOR
C         PUTTING NOAA/EDIS/NGSDC ELEVATION TAPES INTO A READILY
C         ACCESSABLE FORM.
C          (REFERENCE:  USERS GUIDE TO NOAA/EDIS/NGSDC AVERAGE
C           TERRAIN DATA OF THE CONTERMINOUS UNITED STATES FOR
C           TAPAS APPLICATIONS, APRIL 1982  DAVID DIETRICH)
C
C          PROGRAMMER  JOSEPH E. CHILDS
C                      APRIL 15, 1982
C
C          COPYRIGHT  1982  APCOMP, INC.
C
      INTEGER RECLEN, NUMREC
      PARAMETER (RECLEN = 2040, NUMREC =2400)
      REAL RECORD (RECLEN)
       INTEGER RECSTRT, RECEND, RECINC, OBSTRT, OBSEND, OBSINC
C
C
C-----------------------------------------------------------------------
C
      OPEN (8,IOSTAT=IOS,ERR=700,ACCESS='DIRECT',FORM='UNFORMATTED',
     *      RECL=RECLEN+2)
C
C
C             GET THE RECORD POINTERS FOR CHECKING THE DATA CONVERSION.
C
       READ (5,*) RECSTRT, RECEND, RECINC, OBSTRT, OBSEND, OBSINC
C
      DO 10  I=RECSTRT, RECEND, RECINC
            READ (8,IOSTAT=IOS,ERR=705,REC=I) LAT,LONG,RECORD
          WRITE(7,701) LAT, I, OBSTRT, OBSEND
          WRITE(7,703)  (RECORD(J),J=OBSTRT,OBSEND,OBSINC)
 10   CONTINUE
701    FORMAT ( ' LATITUDE ',F9.2,'   RECORD ',I5,
     *  '    OBSERVATION RANGE ',2I6)
703    FORMAT (13F9.2)
C
      STOP 'SUCCESSFUL TERMINATION'
C
 705  WRITE(6,*) 'ERROR NUMBER',IOS,' ENCOUNTERED AT RECORD',I,
     *           'PROGRAM TERMINATES - FILE READ ERROR'
C
      STOP 'ERROR READ'
 700  WRITE(6,*) 'ERROR NUMBER',IOS,'DURING INITIAL OPEN - FILE NOT
     *            PROPERLY STORED.'
C
      STOP 'OPEN ERROR'
      END
```

Figure 3.6 Changes that must be made in SUBGEN for each analysis area

```
/JOB
/PACK
/NOSEQ
BN09,T250,PR30. NOAA/EDIS/NGSDC FILE VERIFICATION.
/READ,USERNBR
RATE,BKG.
ROUTE,OUTPUT,DEF,DC=LP,ID=00.
ATTACH,TAPE8=RANELV4.
DEFINE,TAPE7=REGWEST.
GET,ELV4GEN.
FTN5,I=ELV4GEN,LO,B=BIN,OPT=2.
BIN.
SKIP,EXLAB.
EXIT.
ENDIF,EXLAB.
DAYFILE,L=JOEDAY.
REPLACE,JOEDAY.
REWIND,OUTPUT.
COPYEI,OUTPUT,CHKOUT.
REPLACE,CHKOUT.
/EOR
840, 1408, 8, 1680, 2040, 8
/EOF
```

Figure 3.7 SUBGEN for extracting data via GENFIL from RANELV3 for the eastern portion of the example analysis area

```
/JOB
/PACK
/NOSEQ
BN09,T250,PR30. NOAA/EDIS/NGSDC FILE VERIFICATION.
/READ,USERNBR
RATE,BKG.
ROUTE,OUTPUT,DEF,DC=LP,ID=00.
ATTACH,TAPE8=RANELV3.
DEFINE,TAPE7=VISEAST.
GET,GENFIL.
FTN5,I=GENFIL,LO,B=BIN,OPT=2.
BIN.
SKIP,EXLAB.
EXIT.
ENDIF,EXLAB.
DAYFILE,L=JOEDAY.
REPLACE,JOEDAY.
REWIND,OUTPUT.
COPYEI,OUTPUT,CHKOUT.
REPLACE,CHKOUT.
/EOR
960, 2380,20, 1, 120,20
/EOF
```

Figure 3.8 SUBGEN for extracting data via GENFIL from RANELV4 for the western portion of the example analysis area

```
/JOB
/PACK
/NOSEQ
BN09,T250,PR30. NOAA/EDIS/NGSDC FILE VERIFICATION.
/READ,USERNBR
RATE,BKG.
ROUTE,OUTPUT,DEF,DC=LP,ID=00.
ATTACH,TAPE8=RANELV4.
DEFINE,TAPE7=VISWEST.
GET,GENFIL4.
FTN5,I=GENFIL4,LO,B=BIN,OPT=2.
BIN.
SKIP,EXLAB.
EXIT.
ENDIF,EXLAB.
DAYFILE,L=JOEDAY.
REPLACE,JOEDAY.
REWIND,OUTPUT.
COPYEI,OUTPUT,CHKOUT.
REPLACE,CHKOUT.
/EOR
960, 2380,20, 240,2040,20
/EOF
```

3.5 STEP 5 Submit SUBGEN

Once all files are properly modified and double checked, SUBGEN can be submitted for processing. The result of each SUBGEN run will be a direct access file, as named by the user, containing the requested elevation data. In this example, direct access files named REGEAST and REGWEST contain the requested east and west portions of the example analysis area.

The direct access elevation file created by the program GENFIL will consist of a line of identification information for each latitude record (Format F9.2, I5, 2IG), followed by the appropriate number of elevation observations in each latitude record (Format 13F9.2). These formats will be required to read the data file such as in the creation of a merged data set or generation of TAPAS structured files.

If all data exists within one random access file, the elevation access process is now complete.

3.6 STEP 6 Merging portions of data extracted from RANELV3 and RANELV4

This procedure is only used if the desired analysis area is geographically located such that a portion of the area lies in both RANELV3 and RANELV4. Under these circumstances, the two portions must be merged into a single file.

In the example analysis area, two files have been generated with GENFIL. REGEAST contains the eastern portion of the analysis area and REGWEST contains the western portion. To merge these files the program MERGELV applied through the submit file MERGSUB must be used. Figure 3.9 contains the listing for MERGELV. Figure 3.10 contains a listing for MERGELV and highlights the parameters in MERGELV that must be modified for each MERGELV run. The parameters in Figure 3.10 are the ones used to merge data from the REGEAST and REGWEST example.

Upon the submission of MERGSUB and the successful completion of the MERGELV program, a merged elevation data set is available for further processing.

The direct access elevation file created by the program MERGELV will consist of a line of identification information which only includes the y coordinate location (Format I3) for each latitude record, followed by the appropriate number of elevation observations in each latitude record (Format 13F9.2). These formats will be required to read the data file, such as in the generation of a TAPAS structured file. For one example, the entire file could be read with the following format statement

```
(72(I3,/,6(13F9.2,/),8F9.2))
```

Figure 3.9 Listing of MERGELV

```
      PROGRAM MERGELV(INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT,TAPE8,
     *     TAPE9,TAPE10)
C
C     THIS PROGRAM HANDLES THE RESULTS OF THE GENFIL PROGRAM FROM
C        THE EAST AND WEST HALVES OF AN ANALYSIS AREA, AS EXTRACTED
C        FROM RANELV3 AND RANELV4, AND MERGES THE TWO FILES INTO A
C        SINGLE ELEVATION DATA FILE.
C
C     THE PROGRAM HAS THE FOLLOWING PARAMETERS/VARIABLES:
C
C          EASTELV  -  DATA FOR THE EASTERN HALF OF THE ANALYSIS AREA
C          WESTELV  -  DATA FOR THE WESTERN HALF OF THE ANALYSIS AREA
C          GNUMY    -  THE TOTAL NUMBER OF ROWS (Y DIMENSION)
C          GNUMXE   -  THE TOTAL NUMBER OF ELEVATIONS (X DIMENSION) IN
C                         A ROW FOR THE EASTERN PORTION OF THE DATA
C          GNUMXW   -  THE TOTAL NUMBER OF ELEVATIONS (X DIMENSION) IN
C                         A ROW FOR THE WESTERN PORTION OF THE DATA
C
C
C     THIS PROGRAM CAN HANDLE A FINAL ELEVATION ARRAY OF X=104;
C        Y=USER DEFINED.
C
      DIMENSION EASTELV(100),WESTELV(100)
      INTEGER GNUMY,GNUMXE,GNUMXW
      READ(5,*) GNUMY,GNUMXE,GNUMXW
      DO 100 I=1,GNUMY
      READ(8,1000) IDUM
      READ(8,1001)(EASTELV(J),J=1,GNUMXE)
      READ(9,1000)IDUM
      READ(9,1001)(WESTELV(K),K=1,GNUMXW)
      WRITE(10,1002)I
      WRITE(10,1001)(WESTELV(KA),KA=1,GNUMXW),(EASTELV(JA),JA=1,GNUMXE)
1000  FORMAT(A10)
1001  FORMAT(13F9.2)
1002  FORMAT(I3)
100   CONTINUE
      STOP
      END
```

Figure 3.10 Listing of MERGSUB (the submit file for MERGELV)

Parameters that require modification for each MERGELV application are highlighted

```
/JOB
/PACK
/NOSEQ
BN09,T500,PR50.
USER,FYRY2A2,TAP1.  NOAA/EDIS/NGSDC FILE MERGING
ROUTE,OUTPUT,DEF,DC=LP,ID=00,JN=BN09.
RATE,BKG.
ATTACH,TAPE8=REGEAST.
ATTACH,TAPE9=REGWEST.
DEFINE,TAPE10=REGELVX.
GET,A=MERGELV.
FTN5,I=A,B=MERGBIN,OPT=2.
MERGBIN.
SKIP,EXLAB.
EXIT.
ENDIF,EXLAB.
DAYFILE,L=MERGDAY.
REPLACE,MERGDAY.
/EOR
72, 40, 46
/EOF
```